



United States Department of Agriculture

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United States Standards for Grades of Frozen Corn on the Cob

Effective July 27, 1970
(Reprinted August 2016)

This is a reprint of the United States Standards for Grades of Frozen Corn-on-the-Cob which have been in effect since July 27, 1970 and were updated to modify the format and make minor grammatical and spelling changes.

Voluntary U.S. grade standards are issued under the authority of the Agricultural Marketing Act of 1946, which provides for the development of official U.S. grades to designate different levels of quality. These grade standards are available for use by producers, suppliers, buyers, and consumers. As in the case of other standards for grades of fresh and processed fruits, vegetables, and specialty crops these standards are designed to facilitate orderly marketing by providing a convenient basis for buying and selling, for establishing quality control programs, and for determining loan values.

The U.S. grade standards and inspection instructions for all fresh and processed fruits, vegetables, and specialty crops are available on the internet and upon request at the address below. These documents provide detailed interpretations of the grade standards and provide step-by-step procedures for grading the product.

Grade standards are issued by the U.S. Department of Agriculture (USDA) after careful consideration of all data and views submitted during rulemaking. The Department welcomes suggestions for improving the standards in future revisions. Comments may be submitted to, and copies of standards and inspection instructions obtained from:

Director, Specialty Crops Inspection Division
Specialty Crops Program,
USDA, Agricultural Marketing Service
1400 Independence Avenue, SW, STOP 0240
Washington, D.C. 20250

Authority: 7 U.S.C. 1621-1627.

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United States Standards for Grades of Frozen Corn-on-the-Cob

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§52.931 Product description.

Frozen corn-on-the-cob is the product which is prepared from sound, properly matured, fresh, sweet corn ears by removing husk and silk; by sorting, trimming, and washing to assure a clean and wholesome product. The ears are blanched, then frozen and stored at temperatures necessary for the preservation of the product.

§52.932 Styles.

- (a) **Trimmed.** Ears trimmed at both ends to remove tip and stalk ends and/or cut to specific lengths.
- (b) **Natural.** Ears trimmed at the stalk end only to remove all or most of the stalk.

§52.933 Lengths.

- (a) **Regular.** Ears which are predominantly over 3-1/2 inches in length.
- (b) Ears which are predominantly 3-1/2 inches or less in length.

§52.934 Colors of frozen corn-on-the-cob.

- (a) Golden (or yellow).
- (b) White.

§52.935 Grades.

- (a) **U.S. Grade A or U.S. Fancy frozen corn-on-the-cob** is composed of ears with similar varietal characteristics and that have a good flavor and odor. The ears have a good color; are at least reasonably uniform in size; are at least reasonably well developed; are practically free from defects; and are tender. The product scores not less than 90 points when rated in accordance with the scoring system outlined in this subpart.
- (b) **U.S. Grade B or U.S. Extra Standard frozen corn-on-the-cob** is composed of ears with similar varietal characteristics and that have at least a reasonably good flavor and odor. The ears have at least a reasonably good color; may lack uniformity of size and development; and are at least reasonably tender. The product scores not less than 80 points when rated in accordance with the scoring system outlined in this subpart.
- (c) **Substandard** is the quality of frozen corn-on-the-cob that fails to meet the requirements of U.S. Grade B.

§52.936 Ascertaining the grade of a sample unit.

- (a) **General.** The grade of a sample unit of frozen corn-on-the-cob is ascertained by considering: The flavor and odor which are not scored; the ratings for the factors of color, uniformity of size, development, defects, and tenderness and maturity which are scored; the total score; and the limiting rules which may be applicable.
- (b) **Sample unit size.** For purposes of rating the quality of factors, a sample unit shall consist of four (4) ears; or, if the ears are short ears (trimmed to predominantly 3-1/2 inches or less in length) the sample unit shall be eight (8) such short ears.
- (c) **Definitions of flavor and odor.**
- (1) **Good flavor and odor** means that the product has a good characteristic, normal flavor and odor and is free from objectionable flavors and objectionable odors of any kind.
- (2) **Reasonably good flavor and odor** means that the product may be lacking in good flavor and odor but is free from objectionable flavors and objectionable odors of any kind.

Factors:	Points
Color	20
Uniformity of Size	10
Development	10
Defects	30
Tenderness and maturity	30
Total Score	100

§52.937 Ascertaining the rating for the factors which are scored.

The essential variations within each factor which is scored are so described that the value may be ascertained for each factor and expressed numerically. The numerical range within each factor which is scored is inclusive. (For example, 27 to 30 points means 27, 28, 29, or 30 points.)

§52.938 Color.

- (a) **General.** The factor of color is evaluated immediately after the product has been water-thawed to the extent that the outer surfaces are substantially free from ice crystals.

- (b) **Definition of off-variety kernels.** **Off-variety** kernels are those which are not blemished but which vary markedly from the predominant color and are not characteristic of the variety.
- (c) **“A” classification.** Frozen corn-on-the-cob that has a good color may be given a score of 18 to 20 points. **Good color** means that the corn has a typical, bright color and complies with the requirements for U.S. Grade A in table I.
- (d) **“B” classification.** Frozen corn-on-the-cob that has a reasonably good color may be given a score of 16 or 17 points. Frozen corn-on-the-cob that falls into this classification shall not be graded above U.S. Grade B, regardless of the total score (limiting rule). **Reasonably good color** means a color that may be slightly dull but is not of abnormal color. Such color also complies with the requirements for U.S. Grade B in table I.
- (e) **“SStd” classification.** Frozen corn-on-the-cob that fails to meet the requirements of paragraph (d) of this section may be given a score of 0 to 15 points and shall not be graded above Substandard, regardless of the total score for the product (limiting rule).

Table I - Requirements for Uniformity of Color and Off-Variety Kernels

	Uniformity of color		Off-variety kernels	
	Each ear in the sample unit	All ears in the sample unit	Each ear in the sample unit	All ears in the sample unit
			Maximum number	
U.S. Grade A	Practically Uniform	Reasonably Uniform	3 kernels	6 kernels
U.S. Grade B	Reasonably Uniform	Fairly Uniform	15 kernels	30 kernels

§52.939 Uniformity of size.

- (a) **General.** The rating for uniformity of size is based on the variations in length and diameter of the ears. The diameter is the largest diameter measured at right angles to the longitudinal axis.
- (b) **“A” classification.** Frozen corn-on-the-cob that is practically uniform in size may be given a score of 9 or 10 points. **Practically uniform in size** means that the variations in the diameter and/or length of the ears do not exceed the variations allowed for U.S. Grade A, for the applicable style, in table II.
- (c) **“B” classification.** Frozen corn-on-the-cob that is only reasonably uniform in size may be given a score of 8 points. **Reasonably uniform in size** means that the variations allowed for U.S. Grade B, for the applicable style, in table II.

- (d) **“SStd” classification.** Frozen corn-on-the-cob that exceeds the variations allowed for U.S. Grade B, for the applicable style, in table II may be given a score of 0 to 7 points and shall not be graded above U.S. Grade B, regardless of the total score (partial limiting rule).

Table II - Variation Limits for Diameter and Length

	Trimmed style				Natural Style (untrimmed)	
	Regular length ears		Short length ears			
	Diameter	Length	Diameter	Length	Diameter	Length
U.S. Grade A	1/2 inch	3/4 inch	1/2 inch	1/2 inch	1/2 inch	1-1/2 inches
U.S. Grade B	3/4 inch	1 inch	3/4 inch	1/2 inch	3/4 inch	2 inches

§52.940 Development.

(a) **General.**

- (1) Development refers to the extent that the ears are filled with corn kernels and the pattern arrangement, as applicable, of such kernels on the cob.
- (2) Classification of development defects, if applicable, are made on each ear regardless of length.
- (3) Evaluation of this factor as to grade is made on the basis of a sample unit.

(b) **Conditions of evaluation.**

- (1) The classification of development defects is done after the product has been thawed to the extent that the outer surfaces are substantially free from ice crystals.
- (2) For natural style, development defects over the outermost one (1) inch of the tip end of the ear are not scored.

- (c) **“A” classification.** Frozen corn-on-the-cob that is well developed may be given a score of 9 or 10 points. **Well developed** means that the ears in the sample unit are well filled with kernels and the appearance of none of the ears in the sample unit is materially affected by missing, or underdeveloped kernels. In addition, any development defects present (as defined and classified in this section) do not exceed the allowances in table III.

- (d) **“B” classification.** Frozen corn-on-the-cob that is reasonably well developed may be given a score of 8 points. **Reasonably well developed** means that the ears in the sample unit are reasonably well filled with kernels and the

appearance of none of the ears in the sample unit is seriously affected by missing, or underdeveloped kernels. In addition, any development defects present (as defined and classified in this section) do not exceed the allowances in table III.

- (e) **“SStd” classification.** Frozen corn-on-the-cob that fails to meet the requirements of paragraph (d) of this section may be given a score of 0 to 7 points and shall not be graded above U.S. Grade B, regardless of the total score for the product (partial limiting rule).
- (f) **Definitions and classification of development defects.**

Type of development defect (applicable to each ear, regardless of length)	Classification	
	Minor	Major
Twisted ear: An ear twisted--more that the width of 4 rows of kernels or more than 1/4 of the circumference--from one end to the other	X	
Nonparallel kernels: (Not applicable to varieties which characteristically have staggered rows.) An ear having an area comprised of three (3) or more adjacent nonparallel rows extending more than two (2) inches, lengthwise, of the ear	X	
Separation of rows exceeding 1/2 the length of the ear: One space showing cob more than 1/4, but not more than 1/2, the width of an average size kernel	X	
Two or more such spaces showing cob more than 1/4, but no more than 1/2, the width of an average size kernel		X
A space or spaces showing cob more than 1/2 the width of an average size kernel		X

Table III - Development Defects for Each Grade

Grade classification	Total of Minor only (applicable only when there are no major)	Total of Minor and Major	Limit for Major
	Maximum in the sample unit		
U.S. Grade A	3	2	1
U.S. Grade B	6	4	2

§52.941 Defects.

(a) General.

- (1)** This factor refers to the degree of freedom from such defects as crushed and broken kernels, blemished kernels, poorly trimmed ears, attached stalk, husk, and dark or readily noticeable silk.
- (2)** Crushed and broken kernels, blemished kernels, poorly trimmed ears, and attached stalk are scored on the basis of individual ears, regardless of length.
- (3)** Husk and silk are aggregated and are scored on the basis of a sample unit.

(b) Conditions of evaluation.

- (1)** The classification of defects is done after the product has been water-thawed.
- (2)** For natural style, defects over the outermost one (1) inch of the tip end of the ear are not scored except for those kernels which are classed as blemished.

(c) “A” classification. Frozen corn-on-the-cob that is practically free from defects may be given a score of 27 to 30 points. **Practically free from defects** means that:

- (1)** Any combination of defects present (whether or not specifically defined) may slightly, but not materially, detract from the appearance or edibility of the product; and
- (2)** The defects present (as defined and classified in this section) do not exceed the allowances in Table IV.

(d) “B” classification. Frozen corn-on-the-cob that is reasonably free from defects may be given a score of 24 to 26 points. Frozen corn-on-the-cob that falls into this classification shall not be graded above U.S. Grade B, regardless of the total score for the product (limiting rule). **Reasonably free from defects** means that:

- (1)** Any combination of defects present (whether or not specifically defined) does not seriously detract from the appearance or edibility of the product; and
- (2)** The defects present (as defined and classified in this section) do not exceed the allowances in Table IV.

- (e) **“SStd” classification.** Frozen corn-on-the-cob that fails to meet the requirements of paragraph (d) of this section may be given a score of 0 to 23 points and shall not be graded above Substandard, regardless of the total score for the product (limiting rule).

(f) **Definitions and classifications of defects.**

Types of defects and definitions	Classification		
	Minor	Major	Severe
Applicable to an individual ear, regardless of length			
Crushed or broken kernels (other than those at end of ears caused by trimming or cutting):			
Short length ears:			
7 to 15 kernels	X		
16 to 30 kernels		X	
More than 30 kernels			X
or			
16 or more kernels in one area materially affecting the appearance of the ear			X
Regular length ears:			
10 to 25 kernels	X		
26 to 50 kernels		X	
More than 50 kernels			X
or			
26 or more kernels in one area materially affecting the appearance of the ear			X
Blemished kernels (includes, but is not limited to, kernels affected by discoloration, blemishes, pathological injury, or other damage):			
Short length ears:			
1 or 2 kernels	X		
3 or 4 kernels		X	
More than 4 kernels			X
Regular length ears:			
2 or 3 kernels	X		
4, 5, or 6 kernels		X	
More than 6 kernels			X
Poorly trimmed ears:			
More than 30°, but not more than 45°, from a right-angle cut	X		
More than 45° from a right-angle cut		X	

(f) **Definitions and classifications of defects (continued).**

Types of defects and definitions	Classification		
	Minor	Major	Severe
Stalks:			
More than 1/4 inch, but not more than 1/2 inch, of attached stalk	X		
More than 1/2 inch of attached stalk		X	
The following are aggregated and apply to the entire sample unit			
Attached or loose husk:			
More than one (1) square inch but not more than two (2) square inches	X		
More than two (2) square inches but not more than three (3) square inches		X	
More than three (3) square inches			X
Dark or readily noticeable silk (strands one (1) inch long or longer):			
10 to 20 inches	X		
21 to 30 inches		X	
Over 30 inches			X

Table IV - Defects for each grade

Grade Classification	Total of Minor only (applicable only when there are no Major or Severe)	Total of Minor, Major, and Severe	Limit for Major and Severe	Limit for Severe
Maximum per sample unit				
U.S. Grade A	6	4	1	0
U.S. Grade B	12	9	3	1

§52.942 Tenderness and maturity.

(a) **General.** The tenderness and maturity of the frozen corn-on-the-cob is determined by:

- (1) Checking for presence of a blister-stage of kernel development on water-thawed ears;
- (2) Checking the stages of kernel development in accordance with the method in §52.943; and
- (3) Checking the tenderness of the pericarp and affirming the maturity of the kernels after cooking in accordance with the method in §52.944.

(b) **Definitions of stages of kernel development.**

- (1) **Blister stage:** The kernel contents are thin and watery or slightly cloudy or translucent and the pericarp is generally very pale in color. An ear is considered to be in the blister stage if more than one-fifth of the kernels are in the blister stage.
 - (2) **Milk stage:** The kernel contents are opaque and viscous. Light pressure is required to remove contents.
 - (3) **Early cream stage:** The kernel contents are slightly creamy and viscous. Reasonably firm pressure is required to remove contents which show only slight separation of clear liquid.
 - (4) **Cream stage:** The kernel contents are creamy and thick. Firm pressure is required to remove contents which show no free liquid.
 - (5) **Dough or overmature stage:** The kernel contents are semi-solid or hard and require considerable pressure to remove contents which appears starchy or doughlike.
- (c) **“A” classification.** Frozen corn-on-the-cob that is tender, but none of the ears are in the blister stage, may be given a score of 27 to 30 points. **Tender** means that the kernels are in the milk or early cream stage of maturity and the pericarp is reasonably tender.
- (d) **“B” classification.** If the frozen corn-on-the-cob is reasonably tender, and none of the ears are in the blister stage, a score of 24 to 26 points may be given. Frozen corn-on-the-cob that falls into this classification shall not be graded above U.S. Grade B, regardless of the total score for the product (limiting rule). **Reasonably tender** means that the kernels are in the cream stage or better stage of maturity and the pericarp is fairly tender.
- (e) **“SStd” classification.** Frozen corn-on-the-cob that fails to meet the requirements of paragraph (d) of this section may be given a score of 0 to 23 points and shall not be graded above Substandard, regardless of the total score for the product (limiting rule).

§52.943 Preparation for and evaluation of stages of kernel development.

- (a) The sample unit is water-thawed only to the extent that the ears are substantially free from ice crystals.
- (b) At least three (3) complete adjacent rows of kernels from each ear (or an equivalent number of kernels if the kernels are not in rows) are removed by

- cutting the kernels off, near but above their attachment to the cob.
- (c) The cut kernels from all the ears in a sample unit are well mixed and an adequate representative sub-sample is removed.
 - (d) Sufficient kernels from the sub-sample are squeezed to properly evaluate the degree of maturity in accordance with the definitions in §52.942.

§52.944 Cooking procedure and evaluation of cooked units.

- (a) An adequate representative number of ears in the sample unit are evaluated after cooking to ascertain:
 - (1) The degree of maturity of kernel contents;
 - (2) Tenderness of the pericarp; and
 - (3) The flavor and odor.
- (b) This cooking procedure is not intended as a recipe, but for the purposes of this subpart, frozen corn-on-the-cob is cooked (and the evaluation thereof) is as follows:
 - (1) Place the sample units into rapidly boiling water with sufficient water to completely cover the ears;
 - (2) Return the water to a rapid boil;
 - (3) Maintain a rolling boil for exactly five (5) minutes;
 - (4) Remove the ears immediately, and allow to cool sufficiently to evaluate the factors of maturity, tenderness of pericarp, and flavor and odor by eating the corn directly from the cob.

§52.945 Ascertaining the grade of a lot.

The grade of a lot of frozen corn-on-the-cob covered by these standards is determined by the procedures set forth in the Regulations Governing Inspection and Certification of Processed Fruits and Vegetables, Processed Products Thereof, and Certain Other Processed Food Products (§52.1 - §52.83), except that these provisions apply wherever applicable:

- (a) **Container size.** In considering the size of a container for purposes of selecting samples from a lot, an ear shall be considered to weigh 8 ounces except that ears which are trimmed to approximately 3-1/2 inches or less in length shall be considered to weigh 4 ounces each.

- (b) **Dozen.** In calculating the number of dozens of ears, ears which are trimmed to approximately 3-1/2 inches or less in length shall be considered as 24 of such ears being the equivalent of one dozen ears.

§52.946 Score sheet for frozen corn-on-the-cob.

Size and kind of container				
Container marks or identification				
Label				
Net weight (ounces)				
Style (trimmed or natural)				
Length of ears (inches)				
Color (yellow or white)				
Factors			Grade	Score Points
Color	20		“A”	18-20
			“B”	16-17 ¹
			“SStd”	0-15 ¹
Uniformity of size	10		“A”	9-10
			“B”	8
			“SStd”	0-07 ²
Development	10		“A”	9-10
			“B”	8
			“SStd”	0-07 ²
Defects	30		“A”	27-30
			“B”	24-26 ¹
			“SStd”	0-23 ¹
Tenderness and maturity	30		“A”	27-30
			“B”	24-26 ¹
			“SStd”	0-23 ¹
Total Score		100		
Flavor and odor				
“A” Good; “B” Reasonably good; “SStd” Objectionable.				
U.S. Grade				

¹ Indicates limiting rule.

² Indicates partial limiting rule